Cloud Based E-Learning: Benefits, Issues and Innovation Opportunities

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Abstract— Information technology is greatly influencing teaching and learning styles these days. E-learning has emerged in the past few years as a new paradigm providing the opportunity of getting education through electronic mechanisms, and gaining popularity for its immense benefits it offers to learning environments. At the same time, E-learning presents various challenges to organizations and learners. Cloud computing provides fundamental support to address the challenges by providing various computing services. This paper focuses on various opportunities that cloud based e-learning makes and reviews various benefits and challenges of utilizing cloud computing with E-learning.

Keywords—Cloud Computing, Cloud based E-learning, E-learning, Information Technology

I. INTRODUCTION

Now a days, traditional learning methods are struggling to cope up with rapidly changing requirements of social progress and educational development. Conventional education system is needed to redesign to catch the pace of changing world as influenced by advancement in ICT. Modern approach to teaching and learning such as e-learning platforms therefore becomes unavoidable. [3] Computers equipped with sophisticated softwares offer the solution to solve various problems related to traditional method of learning.

With increasing access to Information and communication technology, E-learning is gaining its popularity day by day. Factors leading to its popularity include less training cost, flexibility, easy to access and availability of variety of courses [4]. However, there are various issues that e-learning systems have to deal with. One of the major issue is requirement of huge investments in IT infrastructure (hardware & software) which many educational institutions cannot afford. Cloud computing addresses such issues related to E-learning and provides better infrastructure for E-learning platforms.

In this paper, we give an overview of e-learning systems and cloud computing and its benefits and various issues related to cloud based E-learning. The rest of this paper is structured as follows: Section II introduces e-learning and discusses its benefits and limitations; Section III describes the core concepts of cloud computing.

Section IV discusses the role of cloud computing in E-learning and also discuss various issues related to cloud based E-learning; Section V discusses various innovation opportunities for cloud based E-learning; followed by the conclusion in Section VI.

II. E-LEARNING

One of the most promising paradigms for modern education is E-learning. E-learning is an effective way to spread knowledge to learner anytime and anywhere. E-learning is commonly referred to the intentional use of networked information and communications technology (ICT) in teaching and learning. It emphasizes on the technology to transform the education and to offer teaching and learning activities over the internet [1]. E-learning could be defined as the delivery of education content via all electronic media, including the Internet, intranets, extranets, satellite broadcast, interactive TV, and CD or DVD [2]. E-learning provides the opportunity for learners to better interact with learning environment and other education resources at their own suitability.

A. Benefits of E-learning

E-learning offers various benefits to teachers and learners. Some of the key benefits are as follows:

1) Flexible: E-learning provides flexibility to users when time and space are considered. It offers education to students anywhere and at their own pace.
2) Ease of access: It is easy to access educational resources and to get enrolment without being physical present at an institute.
3) Increased interaction: E-learning eliminates the barriers of fear that a student might have during physical talk. It helps to build strong interaction between learners and also improve teacher-learner communication.
4) Self-paced: Some E-learning modules gives freedom to students to learn at their own pace.
B. Limitations of e-learning

Despite various benefits and simplicity of e-learning approach to teaching-learning process, it suffers from a number of limitations. Some of which are given below:

1) Establishment Cost: E-learning requires huge investment cost in the form of various technical equipments. Some institutions are not able to afford such huge amount of establishment cost.

2) Restricted courses: E-learning is not suitable for all courses. Some of the courses include field work and requires physical presence of a learner.

3) Internet accessibility: Internet connectivity is required in order to operate e-learning system. Some of the remote areas do not fulfil this requirement.

III. CLOUD COMPUTING

With the increased use of powerful computing technology, the complexity of managing the infrastructure has considerably increased which in turn made the use of computing resources expensive for organizations. Cloud computing is providing a way to address such huge computing power demands [6]. The advent of cloud computing is projected to be a new architecture of IT industry. It signifies a principal change in the way ICT services are delivered [5]. Cloud computing is Internet-based computing wherever shared resources, software, and knowledge are provided to computers and different devices on demand. It allows users to use computing services without being installed and users can access their files and data anytime and anywhere in the world. Development of cloud computing originated from advancements in various technologies like virtualization and multi-core chips, data centre automation, Internet technology and Distributed computing [7]. Fig. 1 demonstrates the roots of cloud computing.

A. Cloud computing service models

Cloud computing employs a service driven business model. Users have plenty of choices concerning the services that cloud computing offers. There are three different set of services that cloud computing offers. [8]

1) Software as a Service (SaaS): This model provides software applications to users which runs on the provider’s infrastructure and are accessed through Client’s browser (e.g. Google Apps and Salesforce.com). [9]

2) Platform as a Service (PaaS): In this provider gives user the platform to develop a new application. This platform include application development environment where customer can use the programming languages and tools from the provider’s cloud infrastructure, such as servers, network and operating systems. [9]

3) Infrastructure as a Service (IaaS): In this model hardware resources (storage) and computing power (memory and CPU) are given as service to the users. Users need not to buy these resources, rather they rent these resources from cloud.[10]

IV. CLOUD COMPUTING IN E-LEARNING

Being Internet based learning process, E-learning holds the potential to transform modern education into a more effective learning process. Traditional E-learning systems were developed and maintained by the organizations itself. Therefore, organizations have to bear lots of expenditure required for maintenance and building the platform. Cloud computing offers considerable support to E-learning process by providing various opportunities to improve teaching-learning process [9]. Cloud computing offers the needed hardware and software resources for E-learning platforms. Organizations engaged in E-learning systems need not to focus on development environment and computing resources, rather they focus on developing content and delivering the information via e-learning system.
Cloud service provider holds responsibility of providing underlying system architecture and maintenance. In other words, cloud service provider gives technical support to E-learning system. Fig. 2 shows the architecture of cloud based E-learning.

A. Why cloud based E-learning?

In previous sections it is discussed that E-learning systems suffer from various limitations. To overcome these limitations cloud computing is used with E-learning systems. Table I shows comparison of different learning modalities with cloud based E-learning.

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<th>Classroom-based learning</th>
<th>Virtual classroom learning</th>
<th>Internally developed learning</th>
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B. Benefits of cloud computing in e-learning

1) Cost effective: In cloud based E-learning, Organization need not to spend huge amounts on computing resources. Cloud provides these resources at much lesser cost. Organizations pay according to their usage. So, cloud computing proves to be cost effective.

2) Easily accessible services: Cloud computing provides services to users irrespective of their geographical location. Continuous availability of services also caters to good cloud experience.

3) Large storage capacity: Cloud offers large storage capacity in comparison to personal computers. So, the use of cloud eliminates the fear of running out of memory for end users.

4) Improved performance: Cloud offers better quality of service by giving superior computing power.

5) Robust Architecture: A cloud deployment is typically built on a robust architecture thus providing resiliency and redundancy to its users.[12]

6) Instant updates: Cloud users remain up-to-date with latest updates because it is the responsibility of cloud service provider to give latest updates without charging extra amounts.

7) Improved document format compatibility: With the use of cloud computing, learners need not to worry about incompatible file formats because files are opened directly from cloud in case of cloud based e-learning applications.[13]

8) High security: In the cloud computing model, data is stored intensively. Relying on one or more data centre, the managers manage the unified data, allocate the resources, balance load, deploy the software, control security, and do the reliable real time monitoring, thus guarantee the users’ data security to the greatest possible degree.[14]

C. Issues related to Cloud based E-learning

Cloud computing helps to boost infrastructure resources for E-learning systems. But, as bulk of information is retained on cloud, it originates various concerns and challenges for the use of cloud computing in E-learning systems. Some of the challenges are given below:

1) Privacy: In traditional computing, private data of user is located on only one location. But, in case of cloud computing data is distributed on various data centres which infringes the privacy of a user.[15]

2) Security: Cloud computing is more vulnerable to man in the middle attacks. Scattering of data makes it less secure than data placed on local desktop systems.

3) Performance and Bandwidth Cost: Although cloud computing offers various resources at lesser cost, but the organizations have to spend a lot of money for bandwidth. Adequate bandwidth is required to carry complex data over the network.

4) Sustainability of data: Another concern related to cloud computing is sustainability of data in case of any failure at service provider level. It must be ensured that data will be valid even if service provider shuts down the service.

5) Political and Legal Issues: Sometimes, legal issues arise when data is located across the boundaries of a user’s nation. Services offered by service provider must be complied with regulations of a particular nation.

V. INNOVATION OPPORTUNITIES

Cloud based E-learning has a bright future in learning industry. IT spending is steadily shifting from traditional IT offerings to cloud services. “More than $1 Trillion in IT spending will be directly or indirectly affected by the shift to cloud during next five years, said Gartner Inc. This will make cloud computing the most disruptive forces of IT spending since the early days of digital age.”[17]. There are variety of innovative E-learning tools that can be collaborated with cloud computing go make it more effective. Following is the brief overview of E-learning innovations:[18]:

1) Automation: Future of E-learning lies in automated course authoring tools. Automation also helps trainers determine how students learn, leading to new strategies to better fit their preferences.


3) Gamification: According to a TalentLMS survey on gamification, roughly 75 percent of the workforce are casual gamers. This makes gamification an essential e-learning tool. Point systems, badges and leaderboards in games connect teams with growth programs.

4) A More Secure Cloud: The cloud has recently had a complete security overhaul, and it is big news for e-learning. The cloud security upgrades led to more secure use by organizations concerned about cyber theft.
Analytics: The invaluable insights gained through analytics allow e-learning platforms to customize all aspects of their activities. This trend is enhancing user experience.

VI. CONCLUSION

There is no denying that E-Learning has come a long way. Even the students from rural areas are adopting this method of learning. Advent of cloud computing has given a better shape to E-learning systems. Cloud based e-learning opens the way for new ideas for further development of E-learning systems. In this paper we verified that cloud computing techniques can be deployed to make to build next generation of E-learning platform. However, cloud computing suffers from a variety of issues which include issues of privacy, security, reliability, legal issues, among others. These will have to be addressed for cloud computing to gain more popularity.

REFERENCES


